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spores out of the sporangia ; (2) to furnish sails for catching the wind by which the spores are distributed.

Ann Arbor, Mich.

EXPLANATION OF PLATE IX.—Fig. 1. Sporangium of *Equisetum arvense*, $\times 80$. This figure is diagrammatic; but the cells are represented in true position and size; *a*, probable line of dehiscence; on each side of this line are the transverse cells; at the left are the longitudinal cells of the dorsal wall; and between transverse and longitudinal cells are the oblique cells.

Fig. 2. Sporangium of *E. arvense* after dehiscence, $\times 30$.

Fig. 3. Diagram of a sporangium of *E. arvense*, $\times 30$. The unbroken median line shows the position of the line of dehiscence before rupture; the dotted line shows the relative amount of shortening of the dorsal and ventral surfaces of the dry sporangium. The dotted line would also represent one border of the gape into the ruptured sporangium.

Fig. 4. Portion of the wall of *E. arvense*, to show cells in the region of the line of dehiscence, $\times 175$. Here are three rows of transverse cells containing rings and spirals.

Fig. 5. Longitudinal section of the lower part of a sporangium of *E. arvense*, with a portion of the scale and scale stalk, $\times 125$: *a*, cells of the scale stalk; *b*, section of the ventral transverse cells of the sporangium-wall; *c*, section of the dorsal wall of the sporangium. Below the cavity of the sporangium is a portion of the peltate scale.

Fig. 6. Transverse section of a sporangium of *E. arvense*, midway between base and apex, $\times 125$: *a*, probable location of the line of dehiscence.

Fig. 7. Spore of *E. arvense*, with the elaters beginning to unwind, $\times 350$.

Fig. 8. Same with elaters outstretched, $\times 350$.

Fig. 9. One of the elaters of the same, showing triangular membrane at the place of attachment, $\times 350$.

Fig. 10. Portion of an elater of the same, showing separation of cellulose from the inner layer, $\times 700$.

Fig. 11. Expanded end of an elater of *E. arvense*, showing a split between the laminæ, $\times 700$.

Fig. 12. Cross-section of an elater of the same, $\times 700$.

Personal reminiscences of Dr. Asa Gray.¹

C. V. RILEY.

The greatest of America's botanists, Asa Gray, will nevertheless be remembered for many other qualities. He was essentially a self-made man, and rose to preëminence through his own good qualities of heart and head, coupled with enthusiasm and perseverance. There was nothing stilted or

¹Remarks made at the Gray memorial meeting, held by the Biological Society of Washington, April 5, 1888.

self-contained about Gray, no congealing atmosphere surrounding him. He was one of the people, and few men, in dying, have had more sincere mourners.

Doing an immense deal of what Prof. Lesley has so fitly characterized as "dead work" in science, he yet found time not only to popularize his favorite study, but to deal pointedly with such broad and philosophic questions as grew out of the vast structure of fact which he so zealously helped to build. Where so much pure systematic work was accomplished, and so much more planned, it is no easy matter (as some of us realize but too well) to rise above the vast detail and lay such a broad educational foundation as this master did.

Gray took a medical course, but can not be said to have had a classical education; yet no man wrote more pleasingly or with more grace and accuracy, and we can all indorse Sir Joseph Hooker's words when he says, in a late able notice, that "How Plants Grow" and "How Plants Behave" for charm of matter and style have no equal in botanical literature, and rival chapters in Kirby and Spence's Introduction to Entomology.

It seems almost a work of supererogation to endeavor to convey any personal reminiscences of one who was so familiar a figure to so many of those gathered together here to do honor to his memory. My own personal relations with him can but reflect those of hundreds of Washingtonians. They grew out of the impulse which had been given to the subject of the interrelation between insects and plants some two decades since—an impulse which his own charming writings did so much to quicken. I shall never forget the keen interest and relish he displayed in the first paper read before the American Association for the Advancement of Science at Dubuque in 1872, on the Pollination of *Yucca* by *Pronuba*. Those present on that occasion will remember with what joy he hailed such a unique case of direct interdependence between a plant and an animal. I have had the privilege of his hospitality at Cambridge, and have spent some joyful hours with him in travel and in camp; but, whether around his own hospitable table, amid the refinement of his home life, or in the herbarium or the experimental gardens surrounding it; whether amid the whirl of travel, or in the quieter enjoyment of camp life on Veta Pass, I have always experienced exceptional inspiration, delight and instruction in the communion. True to his name in color of cloth and

hair, his gray, spare and active form ever conveyed a sense of untiring energy both of mind and body. His unflagging industry and cheeriness, together with an undercurrent of humor—which could no more verge on the gross or profane than the dove could imitate the vulture—made him the life of any party, and I well remember, during the memorable Gray-Hooker excursion in the west, how Sir Joseph and the other English members of the party never ceased to marvel at his unceasing alertness. It was, indeed, difficult to realize Gray's age because of this activity, and at a time in life when men are ordinarily bowed with the weight of years—when the machinery gets out of order and refuses to run smoothly—he could outwalk and outwork most of us. His bright intelligence, genial disposition and charming personality, which, as Hooker remarks, gave him the *entré* to *salons* as well as to the museums of every capital, upon his first visit to Europe, just half a century since, continued through the mellowing influences of age.

One day last October I was dining with a friend in the magnificent new building on the bank of the Thames of the National Liberal Club of Great Britain. The conversation naturally turned on Gladstone: "How does he act and appear," I asked, "when he is among you at the club?" "Oh," my friend replied, "he so entirely throws off his age in animation that he would be one of the youngest of us if we gave him a chance to be; but he sheds such an atmosphere on the few occasions when he visits us, and the members crowd around him so eager to hear his voice and to pay him homage, that he never gets the chance."

Gray had something of this same magnetism, and similarly influenced the younger generation of naturalists on all public occasions. In all my personal recollections of Gray, however, he is indelibly associated with one who must have wielded a most beneficent influence over him. I can not think of them apart. She, his boon companion, with whom we so sincerely condole in her widowed bereavement, was always and everywhere by him. I do not know how much or how little she quietly helped him in his botanical work; but I know that no wife was ever more sympathetic with her husband's efforts, more tender, true and solicitous, than the sweet-faced, lovable and loving woman who is so essentially linked with our recollections of the man. The implicit trust and confidence with which he would appeal to her on all occasions, and the manner in which toward the end he would

depend on her quicker ear and keener eye, were beautiful to behold.

Few men have taken more active part in the discussions of the day, or acted more constantly or prominently as critic and reviewer. Yet, while he could be severe in private, his public censure or blame was tempered not only by consideration, but by the conspicuous justness and soberness of his views. So it came about that he retained the esteem of those he most often condemned. One striking illustration of this trait, within my knowledge, may be referred to. Few men were more often reproved by him than a whole-souled friend of mine who has done much for horticulture and botany, but has, withal (as who of us has not?), sometimes been wrong both in observation and conclusion. Shortly after Darwin's death, a leading natural history magazine published an extremely unjust and personal paragraph about the gentleman referred to, pretending to quote Darwin's opinion. Though he had done much to promote the monthly referred to, Gray was thoroughly incensed at the spirit of the paragraph, and never afterward had the old sympathy with the magazine.

Transcending almost in importance even the influence of his botanical and intellectual work proper, I hold to be the value of the lesson of his simple, stainless life. Hooker points out the great similarity in the lives of Gray and the elder De Candolle. In the purity of his character, in the affability of his manner, in the breadth of his mind, and the democratic approachability of the man, if I may so express it, I can not help coupling his, in thought, with that other great mind which but lately ceased to work, and but lately we met to honor. Spencer F. Baird and Asa Gray had much in common besides the influence which both exerted on natural science.

Gray's private correspondence must have been immense. His hand-writing was rather on the sprawly order, indicative of hurry and pressure, and in this, together with the tendency to abbreviate and the frequent omission or malformation of a letter, recalls that of the illustrious Darwin. The style of his correspondence was pointed, clear and happy, and often spiced with bits of humor—in short, like the man.

The last time I met Dr. Gray was in September of last year during the meeting of the British Association for the Advancement of Science, at Manchester. He had been in Europe for some time, and, as on previous visits, had been everywhere honored, and those Americans in attendance

were glad to find him very much the same active, cheerful spirit as of old. Yet in conversation and upon closer contact a diminution of vigor, a diminished brightness of the eye, and a greater tendency to lean on Mrs. Gray, were noticeable. He was naturally more often in section D (biology) than in the other sections, and frequently on the platform. The reading of the annual address by Prof. Alfred Newton, the president of the section, was an occasion of exceptional interest. Seated upon the platform were many eminent biologists from all countries, but the mention of the name of none of them called forth such universal marks of sympathy and applause as that of our beloved Gray. The occasion was inspiring to an evolutionist because President Newton devoted a large portion of his address to the then unpublished "Life and Letters" of Darwin, the proofs of which he had been allowed to see in advance. Tenderly and sympathetically he dwelt on the charm and the noble character of the man, aside from his work, showing clearly that,

"Whatever record leap to light,
He never shall be shamed."

He laid emphasis on the fact that in that year of British jubilee there was a fitness in the theme, because it was exactly the fiftieth anniversary of Darwin's first conception of his main theory, as shown by an entry in his pocket-book for the year 1837. He alluded most touchingly and feelingly to Gray's part in helping to diffuse and promulgate Darwinism, as clearly brought out in the "Life and Letters," and particularly to the early correspondence with Gray, and the letter of September, 1857, in which was clearly sketched the general outline of the theory of natural selection, and which was so important in establishing the relative claims to priority of discovery of Darwin and Wallace. The very marked and fervid expression of admiration manifested by the audience as Prof. Newton, in this part of his address, faced Dr. Gray, was certainly most gratifying to every American present; and when at the close of the address there was a spontaneous call for the eminent botanist, words can not depict either the emotion of Gray himself or of the audience, as it breathlessly listened to his few words. His voice was weaker than I had ever known it, and so low, indeed, as to be at times unheard in the rear of the hall. In supplementing Newton's feeling contribution to the memory of Darwin, he spoke of natural selection as a thing so self-evident that it no longer needed argument; that, at the same time, it had

little to do with the cause or causes of variation. He intimated that botanists were formulating some new conceptions, but did not indicate what these might be.

Now, I have no idea that Prof. Ward will have left anything unsaid in reference to Gray and Darwinism, for no one is more competent to handle the subject fully and thoroughly; and if I venture, in closing, on a few thoughts which naturally grow out of this my last meeting with Dr. Gray, it is with a feeling that perhaps my able predecessor may not do full justice to the design side of the question.

The opening of our civil war witnessed the beginning of a discussion which, in its effects on the thought and civilization of the future, will be as far-reaching as the contest which eventually led to the abolition of slavery in our land. From the time of the appearance of the "Origin of Species" Gray fought for and Agassiz against the theory of natural selection and of the derivation of species from pre-existing species. The cause of freedom has not more completely conquered in the intervening time than has the cause of evolution. The names of Gray and Agassiz will ever stand in our history as typical of the opposing ideas on this question, as those of Grant and Davis will of the ideas that divided the North and South. What more striking illustration of the completeness of the revolution than that Gray should have succeeded to the place of Agassiz as one of the regents of the Smithsonian Institution!

Gray was almost alone at first in meeting the skepticism and opposition to Darwinism in this country, and no one who is not familiar with his writings can form an idea of the great service he rendered to sound science and true religion by the clear and conservative nature of his advocacy. Yet throughout the long-continued and good-natured correspondence between Gray and Darwin one most marked difference is observable between the two men. Darwin, in the beginning, was more of a theist than at the close of his life, and his work in evolution may be said to have rendered his views more and more materialistic. Gray, on the other hand, always believed that variation in its grander movements, if not in its details, was guided by some power to an ordered and definite result. He was, in fact, one of the greatest advocates of design, and saw in evolution only greater reason for believing in an intelligent cause. To use his own oft-quoted words, he was "scientifically, and in his own fashion, a Darwinian; philosophically a convinced theist, and religiously an ac-

ceptor of the creed commonly known as the Nicene as the exponent of the Christian faith." Every one in my hearing will understand how this expression of faith is perfectly consistent with firm belief in Darwinism and evolution. Yet the manner in which it can be contorted to suit bias in the opposite direction is very well illustrated by the fact that in a recent necrological notice the editor of a French Canadian magazine asserts that Gray never accepted Darwinism and effectively opposed it.

Some of us are so constituted, mentally, that we with difficulty realize in what we see most manifest in the world—in the misery, suffering and misfortune of individuals—with Pope, that

"All nature is but art unknown to thee;
All chance, direction, which thou canst not see;
All discord, harmony not understood;
All partial evil, universal good!"

Darwin's nose, as he tells us, very nearly lost him the chance of a voyage around the world on H. M. S. Beagle, and in discussing the question of design he asked Sir Charles Lyell whether the latter believed that the shape of his (Darwin's) nose had been designed. We may well ask whether there is any heart behind this whirling matter in which brute force seems to prevail. Yet Gray so ably expounded evolutionary teleology that his writings will win over many converts to his views. The inherent unity in nature is manifest; all life seems to be held in one great bond, and the idea of God is strengthened rather than imperiled, because we have a satisfactory conception of His mode of working. The intellect demands truth, but the heart cries for love. Science may proclaim that "God is truth," but religion ever answers "God is love." The mystery of life—of causation—is as great as ever, and none the less hidden because of what little light is shed for us upon the covering. We are profoundly in the dark regarding some of its simplest ways and manifestations. There are few of us who have not been at times weighed down and awed with the sense of an undefined and indefinable presence in nature, and whether we conceive the creative spirit as an all-pervading, interpenetrating presence ever with us and ever at work in His own way, or as some grand controlling engineer who has in the past created and ordained that all things shall work to an ultimate end, there is something alluring in the

idea of design, and, as an article of faith, something sublime.

In contemplating these questions I confess to have been profoundly influenced by Gray's writings, but also to having felt the want of a medium whereby design may be conceived to have operated in the past and may yet be seen to operate. The medium must necessarily be psychic, and, while admitting all logical causes which have been brought forward by evolutionists to explain variation, and fully realizing that natural selection only takes advantage of such variation, I yet believe that there is one influence at work—none the less potent because so subtle, and none the less real because so generally denied—which gives us a tangible theory of design. I allude to the mental impressions—the power of the emotions—of the pregnant mother on her offspring, in inducing either direct modification both psychic and physical, or the tendency thereto, especially under stress or where the necessity to conform to new conditions or environment is great, and the requirements and, as a consequence, the emotions are correspondingly great and exceptional. As a cause of variation this was rejected by Darwin, and the influence is usually denied by medical men on physiological grounds; but we are yet profoundly ignorant of some of the most important functions of both mind and body, and if the fact of such influence can once be established, its bearing on evolution as a prime cause, through impulses from within, of modification that may be guided and directed by an all-pervading mind must be admitted, especially among higher organisms where mind is most developed. Who can safely assert that the fact of such influence is not or will not be established? I have for some time been collecting authoritative data on the subject, and firmly believe, from the evidence, in the power of mind in inducing material modification under the circumstances indicated, and I allude to the matter in this connection because I had occasion to suggest it to Dr. Gray, at Manchester, as a working hypothesis to explain the method of design as affecting animals, and because I was pleased to find him by no means unfavorably inclined to the idea.

Beyond the wonted limit of man's age
He lived, a type of usefulness and peace;
His value growing, with his years increase,
To shed a lustre on our history's page.
Honor was his, and worth excelled by none;
And tempered seemed his being and his powers
By all the sweetness of his loved flowers,

And hers who, for so long, beside him shone,
True-hearted, and may fitly share the wreath
Of fame that crowns him. Health, achievement, love;
These blessed his life, and on his soul serene
(As vouching their continuance after death)
Forever rested, like a brooding dove,
The promise of the gentle Nazarene!

Washington, D. C.

Notes on North American willows. II.

M. S. BEBB.

(WITH PLATE X.)

Salix phylicoides And.—A willow, known of late years as by no means rare in Alaska and on the adjacent shores of Eastern Siberia, was first described by Andersson in his preliminary Synopsis of North American Willows, under the above name, given in allusion to the manifest resemblance which the species bears to *S. phylicifolia*. Subsequently, the same author divided Seeman's specimens, upon which exclusively the species was founded, making of all those which exhibited normally developed aments a second new species, *S. fulcrata*, and retaining the original name, *S. phylicoides*, for a single gathering of a bare half-dozen specimens, all told, made by Seeman at "Awatschka Bay, August, 1848." These, evidently taken from the same plant, present the anomaly, very noticeable in an arctic willow, of aments accompanying full-grown leaves. Prof. Andersson did not overlook the abnormal character of this retarded inflorescence, and it is, therefore, all the more surprising that he failed to appreciate the significance of the fact that most of the capsules are empty and that the few which do contain a little pappus produce no seeds. The diminutive size, to which an exaggerated importance is given in the description, is simply due to non-fertilization! If proof were needed of this I might cite a specimen in the Gray herbarium which, along with the "rectangularly veined" lanceolate-acuminate leaves of the Prodrum *S. phylicoides*, bears one imperfectly fertilized ament, capsules as in Seeman's Awatschka Bay plant and another fully fertilized ament with capsules 2-3 lines long—leaves and fruit of *S. phylicoides*, and on the same twig an ament of *S. fulcrata*!

The species varies much in stature and habit. On the southern shores of Alaska it is apparently a stout bush with